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# Value Chain Analysis of Milled Rice Produce in Husking Rice Mill

M G K Bhuiyan[*1], M M Alam[2], A Rahman[3] and M D Huda[4]

ABSTRACT

This study was aimed to identify the present status of rice milling, map and analyze milled rice along with associated constraints and recommend priority areas of interventions using primary and secondary data during the period of 2012-14. In a quantitative survey, stratified random sampling was used to identify respondents, while qualitative investigations involved focus groups and key informant interviews. About 15,500 husking mills, 650 semi-automatic mills, and 300 automatic rice mills are avaiable in Bangladesh. Husking mills still dominate the rice milling sector and it covers about 70% of total milled rice production. However, recent trends show that the husking rice mills fail to compete with modern automatic and semi-automatic rice mills in terms of quality finished products and market demand. In turn shifting to semi-automatic and automatic rice mills is going on. The milling capacity and capacity utilization of husking mills was found to be 0.8-1.0 $th^{-1}$ and 34%, respectively. Milling cost, profit per ton of fine parboiled rice and BCR for husking were found to be Tk 2,601, Tk 3,637 and 1.4, respectively. The profit margin for parboiled fine rice processed in a husking mill was found to be 37.04%. Employment opportunities in terms of labour and staff requirement for husking mills were found to be 14.17 man hours per metric ton of paddy and 6.95 man hours per ton of paddy, respectively. Husking rice mills produce more broken, less head rice recovery and quality is less than automatic rice mills. Beside these, in husking mill bran and husk are mixed together that's not suitable for edible oil extraction and briquette production. In terms of quality of rice e.g. less broken rice, absence of stones and black kernels, brightness, colour etc, the rice mills having modern equipment produce higher quality rice, with higher market demand and higher profit making ability compared to rice mills having traditional equipment.

**Key words:** Value chain, husking rice mill, engelberg huller, BCR, technical performance.

## INTRODUCTION

Rice is the most important crop, accounting for 80% of cropped land in Bangladesh and yielding approximately 36.60 million metric tons of clean rice from a total rice area of 11.40 million hectares (BBS, 2020). Different types of mechanized rice mills, popularly known as engelberg huller (traditional and husking rice mill), semi-automatic rice mills, and automatic rice mills process the majority of paddy produced in the country. The Directorate General of Food has classified three types of rice mills: husking, semi-automatic, and automatic rice mills, and enlisted with numbers to be 14239, 457, and 142, respectively (DG Food, 2007). In addition, the nation has about 100,000 traditional engelberg type rice huller mills. Traditional rice hullers, husking rice mills, semi-automatic rice mills and automatic rice mills employ a total of 1,00,000, 1,42,390, 13,710 and 6,248 workers, respectively. In Bangladesh, the rice milling sub-sector is still considered as an informal sector, with limited government facilities

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and incentives compared to the industrial sector.

Poor technical performance of milling machinery causes losses in the milling process, resulting in poor milling yields. About 90% of the produced paddy in Bangladesh is parboiled. The rubber-roll huller automatic and semi-automatic rice mill is processed about 20% parboiled and 10% of dry processed (unparboiled) paddy. Thirty per cent of the total paddy produced in the country is processed by households and does not come to market. The remaining 70% of paddy is processed in various types of medium to large rice mills (Dasgupta, 2001). The milling of rice in Bangladesh is mainly done by engelberg type steel huller and incurred a substantial amount of loss in recovery of head rice. In husking mills, bran and husk are also mixed in the milling process, and reduces the quality of rice bran. Instead of engelberg rice huller, the use of modern milling machinery could reduce 2-4 % of loss. Considering milling of about 27 million metric tons of paddy annually could increase the yiled of 0.648 million tons of milled rice that is almost a quarter of total whole rice import (Kabir, 2008). Baqui (2010) reported that there is a scope for saving food, on average 4.5 percent by using modern rubber roll milling technology. Hence, the total average national savings would be about 1.55 million tons per year.

Rice milling is an important sub-sector in Bangladesh, but very limited work has been done to determine the current status of this sub-sector in terms of business size, technology level and commodity value chains and processing machinery marketing chain. Over the last 40 years, Bangladesh's rice production increased significantly and this performance has been strongly linked to the high yielding varieties caused by the economic liberalisation of main input markets such as irrigation and fertilizers. (Ahmed, 2000; Hossain, 1998 and Hosain, *et al.*, 2006). Although rice production increased in recent years, resulting in self-sufficiency in rice food security, rice access to consumers has not yet been stabilized, and as a result, price fluctuations by days, hours and even minutes have become a common phenomenon. This means that the main concern of the rice supply chain is to determine the appropriate demand and meet it properly in a profitable manner. For effective sourcing, processing, distribution, and retailing, as well as meeting the customer requirements without facing any crises, a proper supply chain management framework is essential. The rice supply chain in Bangladesh is a focus for food security and climate change considerations. Bangladesh's rice supply chain is based on demand.

The implementation of a demand-driven supply chain is a difficult task (Selen and Soliman, 2002). Any consumer demand may trigger the execution of various activities by various contributors (Prahalad and Ramaswamy, 2000), making demand-driven supply chains highly dynamic and requiring various modes of cooperation, control, and coordination. Effective and sustainable supply chain management of rice milling systems should take into account not only total supply chain costs, but also inventory decisions and policy development.

The term "value chain" involves a wide range of activities required to take a product (or a service) from conception to delivery to final consumers and disposal after use (Kaplinsky, 1999; Kaplinsky and Moris, 2001). A systematic approach is urgently needed to analyze the rice milling value chains to identify the constraints and possible ways of improvement of the sub-sector and recommend a course of action for the policy makers. At this end, value chain analysis of the rice milling sub-sector would be an appropriate tool for

Rice is the most important crop, accounting for 80% of cropped land in Bangladesh and yielding approximately 38.86 million metric tons of clean rice from a total rice area of 11.677 million hectares (DAE, 2020). Different types of mechanized rice mills, popularly known as engelberg huller (traditional and husking rice mill), semi-automatic rice mills, and automatic rice mills process the majority of paddy produced in the country. The Directorate General of Food has classified three types of rice mills: husking, semi-automatic, and automatic rice mills, and enlisted with numbers to be 14,239, 457, and 142, respectively (DG Food, 2007). In addition, the nation has about 100,000 traditional engelberg type rice huller mills. Traditional rice hullers, husking rice mills, semi-automatic rice mills and automatic rice mills employ a total of 1,00,000, 1,42,390, 13,710 and 6,248 workers, respectively. In Bangladesh, the rice milling sub-sector is still considered an informal sector, with limited government facilities and incentives compared to the industrial sector.

Poor technical performance of milling machinery causes losses in the milling process, resulting in poor milling yields. About 90% of the produced paddy in Bangladesh is parboiled. The rubber-roll huller automatic and semi-automatic rice mill is processed about 20% parboiled and 10% of dry processed (unparboiled) paddy. Thirty per cent of the total paddy produced in the country is processed by households and does not come to market. The remaining 70% of paddy is processed in various types of medium to large rice mills (Dasgupta, 2001). The milling of rice in Bangladesh is mainly done by engelberg type steel huller and incurred a substantial amount of loss in recovery of head rice. In husking mills, bran and husk are also mixed in the milling process, and reduces the quality of rice bran. Instead of engelberg rice huller, the use of modern milling machinery could reduce 2-4 % of loss. Considering milling of about 27 million metric tons of paddy annually could increase the yieled of 0.648 million tons of milled rice that is almost a quarter of total whole rice import (Kabir, 2008). Baqui (2010) reported that there is a scope for saving food, on average 4.5 percent by using modern rubber roll milling technology. Hence, the total average national savings would be about 1.55 million tons per year.

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**Table 1. Sample distribution of rice mill for survey.**

| Rice mill | Covered | | | |
|---|---|---|---|---|
| | *Dinajpur* | *Kushtia* | Mymensingh | Total |
| Husking rice mill | *22* | *21* | 22 | 65 |

**Table 2. Sample distribution for main actor for survey.**

| Actor | Dinajpur | Kushtia | Mymensingh | Total |
|---|---|---|---|---|
| Paddy aratdar | 10 | 08 | 10 | 28 |
| Rice whole saler | 12 | 10 | 08 | 30 |
| Rice retailer | 20 | 12 | 10 | 42 |

**Survey questionnaire**

Semi-structured questionnaires were prepared with active consultations of key informants, experts from the relevant areas and secondary information according to the objectives of the study. Two sets of semi-structured questionnaires were also developed to assess the status (services required, service providers, etc) of demand and supply side of Business Development Services (BDS). Furthermore, a checklist was developed for KIIs. The draft questionnaires and the checklist have been pre-tested and the required changes, additions and modifications have also been made.

**Data collection method**

Data were collected by personal interview through semi-structured questionnaires and Focus Group Discussions (FGD). During the interview each question was explained to the respondent clearly and tried to find out facts as much as possible. Appropriate participatory tools and techniques were used in FGDs.

**Techniques applied**

A simple descriptive statistical method was used for analyzing data. Data were analyzed in Excel format separately, computed the operational cost of rice mills from primary and secondary sources. The Excel format allows for quick and easy changes or refinements to any data, as well as the automatic calculation of operational costs for such changes or refinements in the Excel computation mode.

**Data collection on present status of engelberg huller milling in Bangladesh**

A semi-structured questionnaire was used to collect information on the current status of rice milling by engelberg huller. Ownership status, existing items, types of milling machineri used in the mill section, and overall cost of mill/mill section for commissioning were also collected. Cleaning, soaking, steaming, drying, milling, and other operations were also studied, as well as capacity utilization and rice milling recovery.

**Capacity utilization**

Capacity utilization is one of the important dimensions for assessment of market performance of any industry. An attempt is made to assess the performance by using the total processing capacity and the actual amount processed last year by the selected mills.

Capacity utilization of the selected mills of the paddy processing industry was computed by using the following formula:

$$\frac{\sum_{i=1}^{n}(PC)i}{\sum_{i=1}^{n}(AC)i}$$

Where

(PC)i stands for actual processing capacity of ith mill

(AC)i stands for installed capacity of the mill

n= number of rice mills

**Value chain analysis**

This study's value chain approach to rice milling in Bangladesh is designed into nine steps (Fig.1).

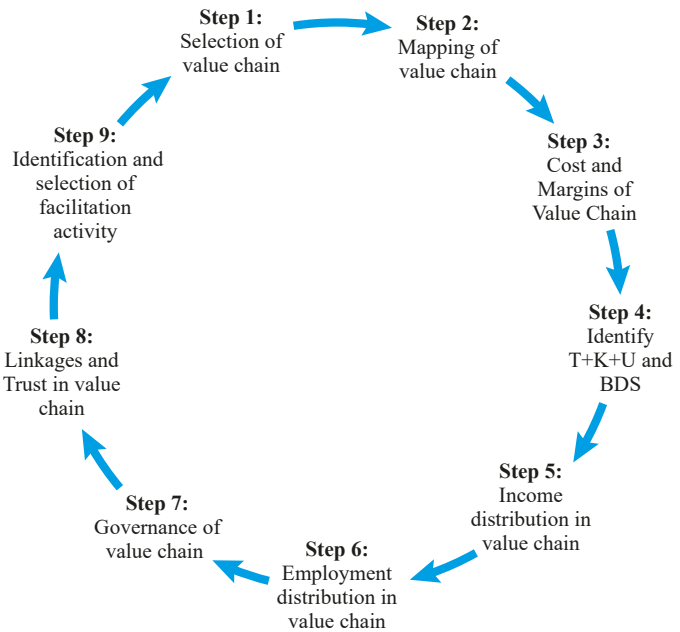


Fig. 1. Steps in value chain Business Service Approach to programme design.

The selection of value chains is the first step of the process. Step two starts with value chain mapping, which illustrates all of the major actors in rice milling value chains in a graphical format. Step three, analyzes the cost and margins of rice milling value chain. Step four, begins with the upgrading of knowledge, skill and technology. In this step, a detailed interview with relevant actors will identify different knowledge, technologies and skills, as well as constraints of actors at different levels of the value chain. Step 5 involves understanding the distribution of income in the value chain and the way income is distributed across actors in the value chain and identifying income generation opportunities. Step six, deals with employment distribution of value chain. Step seven and step eight, concerns the linkage and trust in identifying the reasons for the linkage, and whether the linkages are beneficial or not for the value chain for the rice milling. Step nine deals with the identification and selection of facilitation activities.

**Identifying value chains for analysis**

Selection of the value chain was done in active consultation with key informants such as, professor, researcher, rice mill

owner/manager, rice mill machinery importer and manufacturer. The selected value chains are; fine rice value chain, coarse rice value chain. For value chain analysis one Engelberg huller mill was selected for in depth study and the rice mill situated in Gouripur of Mymensingh district. Selected rice mill was analyzed for cost and margin of fine rice and coarse rice value chain. In this case, milled rice products of individual mills was selected.

**Mapping the value chains**

A value chain map illustrates all of the major actors in the rice milling value chain in graphical form. It depicts the core processes, main actors involved in the processes, product flows, related knowledge and information flows, product volume, relationships and linkages among value chain actors. Focus group discussions (FGDs) and informal interviews with value chain actors were used to map value chains.

**Analyzing costs and margins in the value chain cost analysis**

In this study economic profitability of rice processing was estimated based on economic analysis considering the fixed cost (depreciation, interest, taxes, insurance etc of the machine and land) involve in rice milling were calculated by the following equation as described by Hunt (1995) and Kepner *et al.* (1978) and variable costs (labour, repair and maintenance, electricity, management cost, stuff salary etc.) also taken in consideration.

(a) Annual depreciation, $D = \frac{P - S}{L}$ (1)

Where, D = depreciation, Tk/yr, P = Purchase price of machine, Tk, S = Salvage value of machine, Tk and L= life of the machine, year. In this study, salvage value is assumed as 10 percent of the purchase price.

(b) Interest on investment, $I = \frac{(P + S)\, i}{2}$ (2)

Where, P= Purchase price, S = Salvage, i= Interest rate

**Taxes**

The cost of taxes was considered as 1.4% purchase price of the machine and equipment.

(c) Taxes, T = 1.4% of P (3)

**Insurance**

The cost of insurance was considered to be 0.25% of purchase price of the machine and equipment.

(d) Insurance, Ins. = 0.25% of P (4)

Where, Ins.=Insurance, Tk/yr, P=Purchase price of machine and equipment involved, Tk

**Total fixed cost of machinery**=*(a+b+c+d)* (5)

**Benefit cost ratio**

For profit contexts, a BCR may be used as a profitability measure. The benefit cost ratio (BCR) compares the amount of money saved by completing a project to the amount it costs to complete the project. BCR =Discounted value of incremental benefits/Discounted value of incremental costs.

**Upgrading knowledge, skills, technology and business development services**

The gap between the quality demanded by the consumer and the current quality offered to the consumer by various segments of producers was studied using this method. Additionally, an opportunity for upgrading knowledge, skill and technology was identified, as well as potential service providers to make the appropriate upgrading accessible and possible were mapped.

**Analyze constraints related to knowledge, skills and technology in the processes of the value chain**

In this stage different types of knowledge, technologies, and skills were used, as well as constraints faced by actors at various levels of the value chain were identified through in depth interview of the relevant actors. Technology/product growth, market access, input supply, management and organization, regulation, finance, and infrastructure were all classified as constraints.

**Identification of business services**

After identifying and noting a constraint during the interview, the interviewer asked the actor if there are any services that currently or theoretically, address that constraint. These services have been noted. Business services were defined in this way as being directly related to value chain

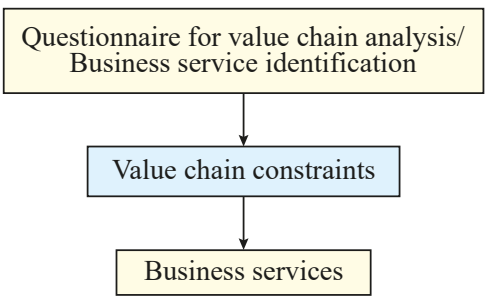


Fig. 2. Flow of information from the value chain questionnaire.

**Selection of business services**

The identified business services are shortlisted and prioritized in order to select those that will be subjected to a more detailed analysis. An "attractiveness" matrix tool was used to create short lists of business services. This matrix ranks business services based on two major criteria: a) the potential for the service to increase the target group's income, and b) the potential for the service to attract a significant number of customers. The highest priority was given to business services that fell within a pre-determined "attractive" range.

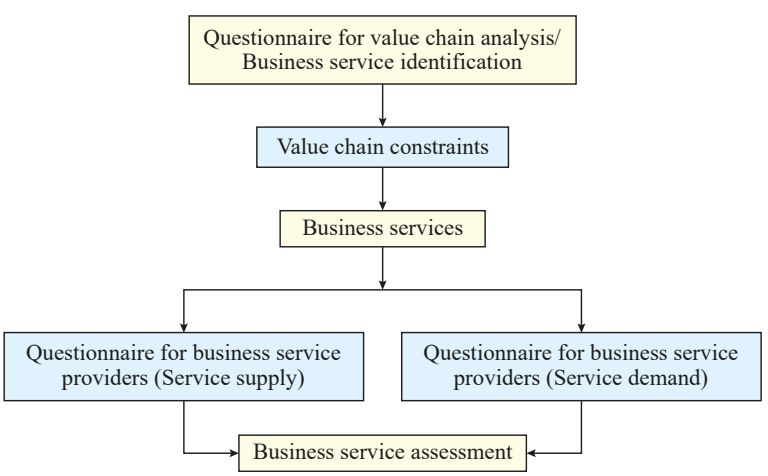


Fig. 3. Flow of information for Business Service Assessment

Regarding the selection of the business services to target, they are subjected to a more detailed investigation. Existing providers, market size and penetration, frequency of usage, demand and supply side constraints and opportunities, satisfaction with service, awareness of the service, proposed providers to aim for interventions and feasibility of the service were all compiled and analyzed for each targeted service (how costs for the service are covered). Fig. 3 depicts the method.

**Analyzing Income distribution**

Understanding how income was distributed through the value chain offers the requisite start to identify opportunities for income generation. An actor in value chain may be involved in several income generating activities within or different value chains. As a result, the sum of various actors' sources influences their livelihood strategies, and any analysis must take into account. The value chain study was compare income distribution of different actors in a value chain and different value chains.

**Analyzing employment distribution**

Understanding how employment were distributed throughout the value chain provides the necessary start to identify employment opportunities. The comparison of employment across various levels in a value chain will be carried out to provide an overview of the employment distribution and benefits for individuals at each level of the value chain.

**Governance: Coordination, regulation and control**

The goal of governance analysis is to look at the rules that regulate a value chain, as well as the system of coordination, regulation, and control that governs how value is created along the chain. Both the "official" laws that address output and the commercial imperatives of competition that influence how production is structured are referred to as governance. Types of rules and regulations, enforcement agencies and sanctions, knowledge and awareness gaps and BDS provisions will be identified through interview and FGDs with concern actors.

**Linkages and trust**

Linkage analysis involves not only determining which organizations and actors are linked to one another, but also determining why such linkages exist and whether they are beneficial or not. Actors in the value chain form links with one another primarily for the good of such relations. Business linkages are the most common within a value chain, and they may be formal or informal. The formal linkage is to the domain of social capital, where trust can play a key role. Interviews with related value chain actors will be conducted to determine their linkages and trustworthiness with other chain actors. First, a list of key actors in the value chain will be created. Second, a survey instrument was developed with a set of questions on linkages and trust.

**Identification and selection of facilitation activities**

The value chain approach used a one-day workshop with value chain actors (faria, bepari, aratdar, millers, wholesalers, retailers, and others) to identify facilitation interventions for selected business services. The workshop's key goals were to: 1) validate the assessment of business services in value chains, and 2) propose market-development interventions for those services. Following the development of a list of potential interventions, each intervention was assessed against specific criteria established by each implementing organization.

RESULTS AND DISCUSSIONS

**Present status of rice milling**

According to Rice Mills Owners Association there are about 17000 rice mills in the country. About 200 semi-automatic and automatic rice mills existed in 2005. In 2011, the number more than tripled, to about 600. The field survey of this research and Rice Mill Owners Association reveal that, there are 15,500 husking mills, and the number of semi-automatic and automatic rice mill in 2015 was estimated more than 950. Husking mills owner say, this mill at present have control over two-third of the market. Because of the increasing demand of automatic rice mill processed rice, it is projected that the share will be half of the total processed rice within couple of years.

**Husking mill**

Husking mills have drying floor for sun drying of rice, well-built godown, traditional drum boilers for steaming and boiling house. The process involves cleaning of paddy, soaking, steaming, steeping, sun drying, milling with engelberg huller, aerating and bagging. Boiler in husking mills is not standard. There was no system of measuring steam pressure and consequently, over and under steaming often affects the quality of rice. Steeping in this system consumes much time. Drying is not uniform as it is done on yard by sun. Engelberg huller produces more broken and under polished rice. Bran and husk are also mixed together. Rice produced in this system has less storage value and vulnerable to insect-pests and micro-organism, and off-coloured within a short period. Fig. 4 shows the low diagram.

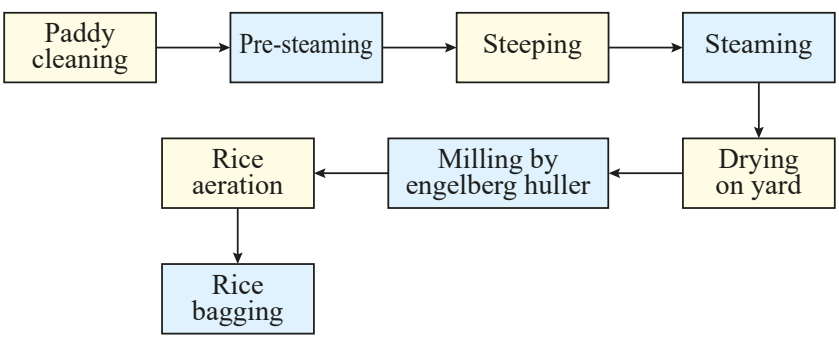


Fig. 4. Flowchart of a husking mill operation in Bangladesh.

**Milling cost and recovery of rice for Husking rice mill**

Table 3 shows the milling cost and recovery per ton of whole rice (fine and coarse).

**Table 3. Milling cost and recovery of fine and coarse rice for engelberg huller rice mills**

| Type of rice mill | Type of rice | Milling cost, Tk /ton of rice | Whole rice recovery % |
|---|---|---|---|
| Husking | Fine rice | 2601 | 65.0 |
| | Coarse rice | 2519 | 67.5 |

In Table 3, it was found that, fine rice processed in husking mill required Tk 2,601 to produce one ton of rice and whole rice recovery was 65%. Similar milling recovery (66%) was found in air blow type engelberg huller (BRRI, 2013-14) and (BRRI, 2015-16). However, the market price of rice processed in rice mill having modern equipment is higher than the other rice mills. The operating cost of husking mill was found Tk. 2601; this happened due to small amount of paddy is processed by husking mill. In Table 3, it was found that, for coarse rice, the operating cost for husking mill was Tk 2,519 and whole rice recovery was 67.5% for producing one ton of rice. Kibria (2018) reported that, automatic rice mill operating cost was found Tk 2,522 that's, almost same of the husking mill operating cost, because the capacity of husking mill is low compared to automatic rice mill.

**Milling capacity of husking (engelberg) rice mill**

Milling capacity indicates the amount of rice processed in a specified time. The capacity of mills is expressed in terms of clean rice. Table 4 shows the milling capacity of the husking rice mill.

**Table 4. Milling capacity of husking rice mill.**

| Type of rice mill | Capacity ($th^{-1}$) |
|---|---|
| Husking mill | 0.8-1.0 |

Results showed that the capacity of husking rice mills were 0.8-1.0 $th^{-1}$. Baqui (2010) found that, the capacity of husking rice mills was found less than 1.0 t/h; similar results were observed for husking rice mill in BRRI (2013-14). Capacity depends on operator efficiency, machine efficiency and also feeding rate of materials.

**Capacity utilization**

Processing capacity utilization of rice mills was computed on the basis of average use in a year and table 5 shows the results.

**Table 5. Capacity utilization of husking rice mills**

| Type of mill | No. of mills | Actual capacity (metric ton) | Capacity utilized (metric ton) | Capacity utilization (%) |
|---|---|---|---|---|
| Husking | 20 | 38016 | 12672 | 34 |

The capacity utilization of husking rice mills was found to be 34% (Table 6). Raha *et al.* (2012) found that the capacity utilization of husking, semi-automatic and automatic mill was 54%, 52% and 56%, respectively. In case of husking and semi-automatic rice mills, it operates with a limited amount of paddy, does not operate round the year, technology varies from mill to mill, use of older technology, and inefficient operators may have influenced the capacity utilization.

**Selection of value chain**

There are several methods for selection of value chain, in this study, milled rice value chains were identified in active consultation with value chain practitioners, university professors, researchers from various organization, rice mill owners and rice mill association. In Bangladesh, 90% of total production of rice is parboiled and the rest 10% is un-parboiled including aromatic rice. Depending on the status of rice milling and consultation of the relevant two value

stakeholders two value chains were identified for milled rice:

- Fine rice value chain
- Coarse rice value chain.

**Mapping the core processes in the value chain**

It includes major processes that raw materials go through before they enter the final consumption stage, such as the provision of raw material inputs. Paddy production was followed by paddy collection and trade, processors, wholesale marketing, retail marketing, and finally consumer marketing (Fig.5).

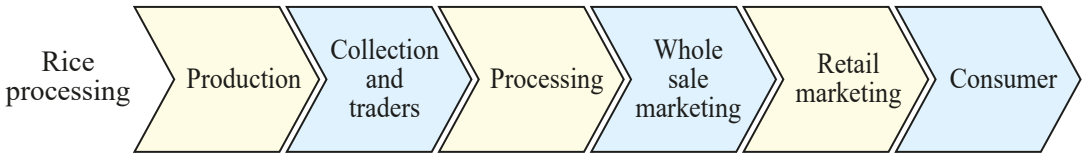


Fig. 5. Core process of fine and coarse rice value chain.

**Identifying and mapping the main actors involved in the process**

The people involved as main actors in the value chain were identified. The most obvious distinction was between categories of actors based on their main occupation. The main actors were identified and mapped based on their main occupation. The main actors for fine and coarse rice value chain are rice farmers, rice faria/ bepari/aratdar/commission agent, rice miller, rice wholesaler and rice retailer etc. (Fig.6).

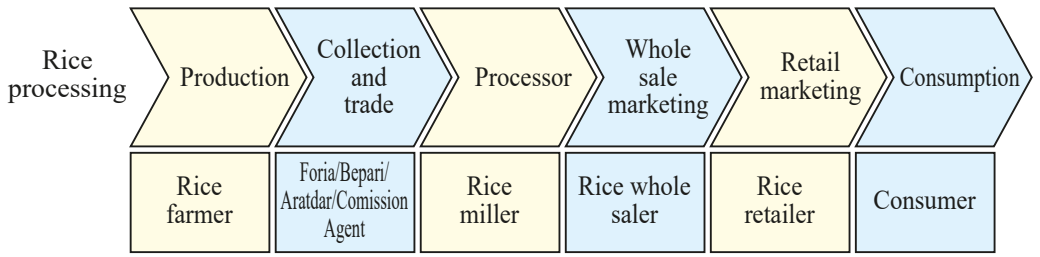


Fig. 6. Main actors in fine and coarse rice value chain.

**Analyzing costs and margins of the value chains**

In this study economic profitability of rice processing was determined based on economic analyses considering the fixed and variable costs involved in rice milling. Two types of value chains were analyzed, they are; fine rice value chain, course rice value chain;

**Fine rice value chain**

In the fine rice value chain husking rice mills were analyzed for the value addition considering every step of rice processing of fine rice.

**Value addition of parboiled fine rice processing in husking mill**

The value chain analysis of parboiled fine rice processed with husking mill indicated that husking miller (64.91%), retailing (15.41%) and wholesaling (14.55%) constituted the major value additions, while commission agent's value addition was only 4.72% (Fig. 7).

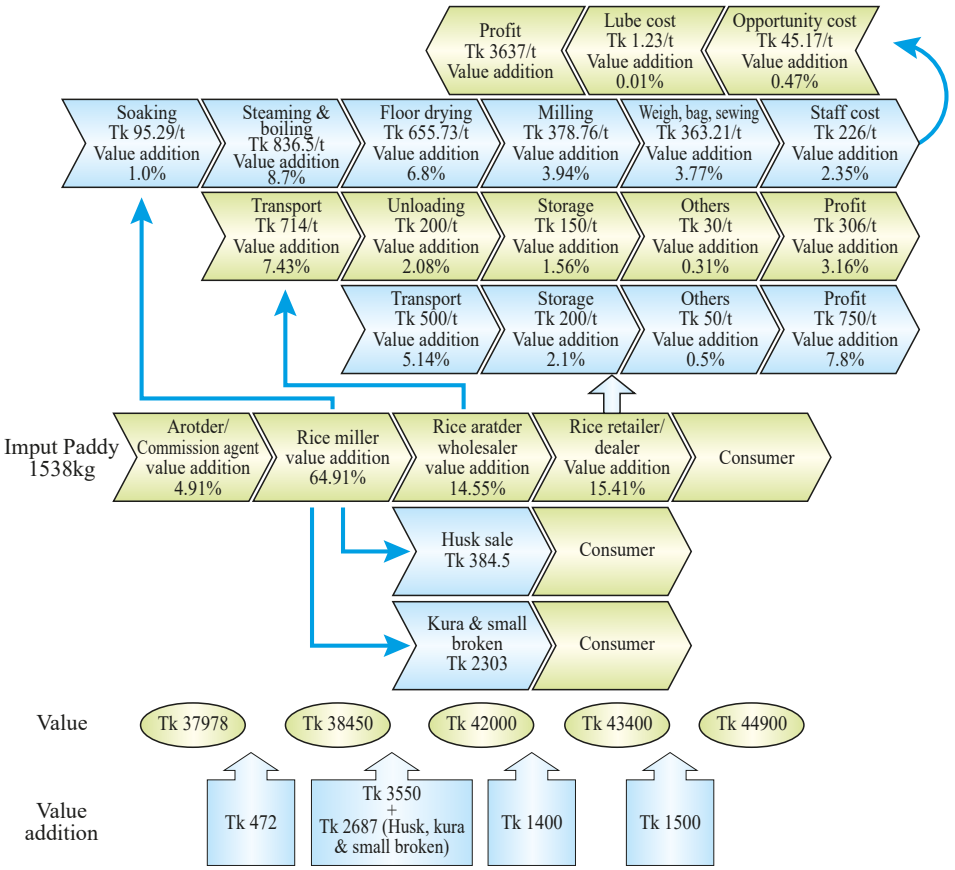


Fig. 7. Value addition of parboiled fine rice in husking mill.

The initial value of 1,538 kg paddy equivalent to one ton of clean rice was Tk 37978, and retailing price was Tk 44,900. Rice miller adds major value in the chain. The value addition at the husking mill consisted of Tk 3,550 in the processing and Tk 2,687 by selling husk, kura and broken rice. The value addition occurred 1% in soaking, 8.7 % in steaming and parboiling, 6.8 % in floor drying, 3.94% in milling, 3.77% in weighing, bagging and sewing, 2.35% in stuff cost, 0.47% in opportunity cost and 0.01% in lubrication cost.

**Milling cost, by product selling cost and benefit-cost ratio of parboiled fine rice processing**

Table 6 shows milling cost, by product selling price and benefit cost ratio of parboiled fine rice.

**Table 6. Comparative milling cost, by product selling price and benefit cost ratio for parboiled fine rice.**

| Type of rice mill | Milling cost, Tk/ton of rice | Profit, Tk/ton of rice | | | BCR |
|---|---|---|---|---|---|
| | | Rice milling | Byproducts' (husk, bran and broken rice) | Total | |
| Husking | 2601 | 949 | 2688 | 3637 | 1.40 |

Milling costs and profit margin per ton of rice was found Tk. 2601 and Tk. 3667, respectively for traditional husking rice mills. Interestingly, by-products such as husk, bran and broken rice contribute significantly to the profit margin of the husking rice mills. The husk is being used as fuel for boilers and dryers in the rice mills, making briquette as bio-fuel and as poultry and dairy feed. The estimated BCR for husking rice mill was found to be 1.40.

**Coarse rice value chain**

In the coarse rice value chain husking rice mill was also analyzed for the value addition considering every step of rice processing of coarse rice.

**Value addition in parboiled coarse rice process in husking mill**

The value chain analysis of parboiled coarse rice processed with husking mill indicated that miller (64.50%), retailing (15.46%) and wholesaling (14.27%) constituted the major value additions. Value addition at commission agent was 4.55% (Fig. 8).

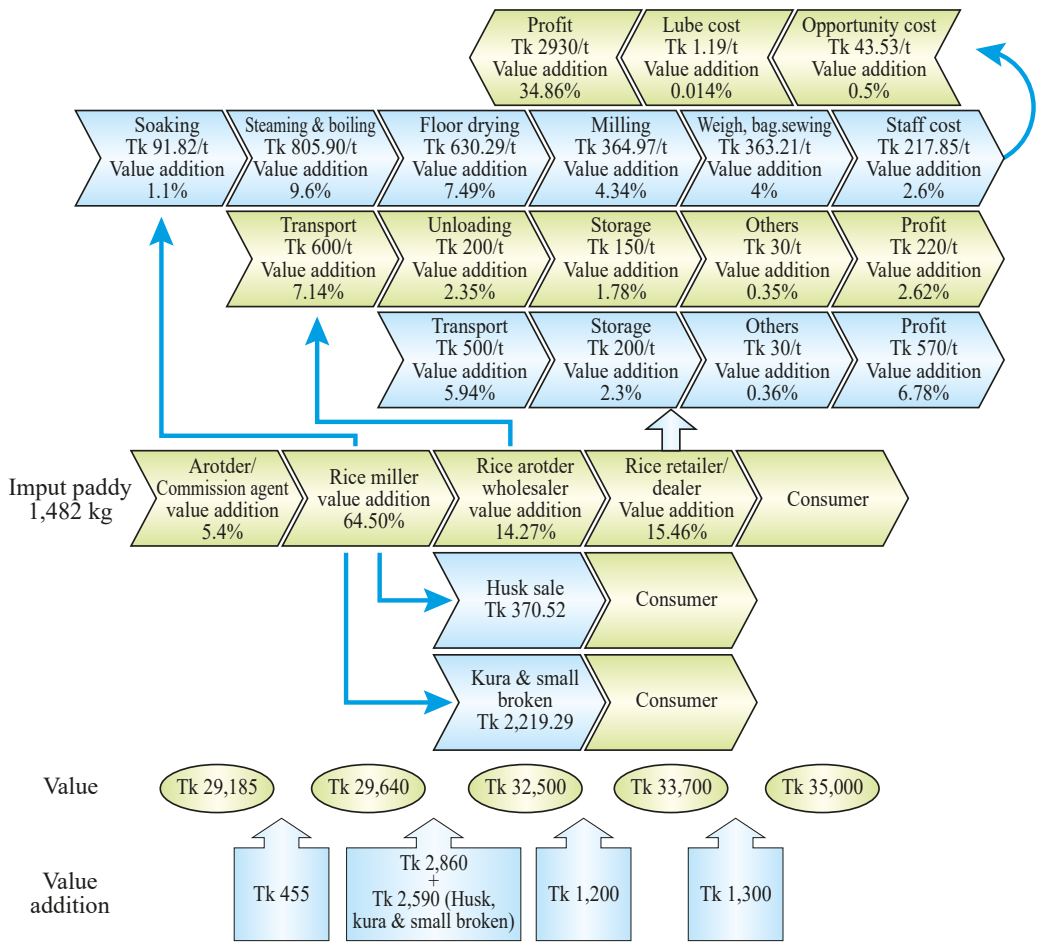


Fig. 8. Value addition of parboiled coarse rice in husking rice mill .

Price of 1,482 kg of paddy equivalent to one ton of clean rice was Tk 29,185, while the retailing price was Tk 35,000. Value additions at Miller's level were Tk 2,860 in the processing and Tk 2,590 by selling husk, kura and broken rice. Value addition contributed 1.09% in soaking, 9.6% in steaming and parboiling, 7.49% in floor drying, 4.34% in milling, 4% in weighing, bagging and sewing, 2.60% in stuff cost, 0.5% in opportunity cost and 0.014%in lubrication cost. Value addition at wholesale level consisted of 7.14% in transport, 2.35% for unloading and 1.78% in storage. The retailer value addition included 5.94% in transport, 2.3% in storage and 0.3% other cost.

**Milling cost, by product selling cost and benefit-cost ratio of parboiled coarse rice processing**

Table 7 shows omparative milling cost, by product selling price and benefit-cost ratio of parboiled coarse rice.

**Table 7. Comparative milling cost, by product selling price and benefit cost ratio for parboiled coarse rice.**

| Type of rice mill | Milling cost, Tk $t^{-1}$ of rice | Profit, Tk $t^{-1}$ of rice | | | BCR |
|---|---|---|---|---|---|
| | | Rice milling | Byproducts' (husk, bran and broken rice) | Total | |
| Husking | 2519 | 341 | 2590 | 2930 | 1.16 |

Milling costs and profit margin per ton of rice in traditional husking rice mill was found Tk 2,519 and Tk 2,930, respectively. Interestingly, byproducts such as husk, bran and broken rice contribute significantly in profit margin of husking rice mill. The estimated BCR was found 1.16 in husking rice mill.

**Constraints of rice mills**

The major constraints that were identified through in-depth interviews of the sub-sector actors (traders, millers, wholesalers, retailers, government and non-government organizations, agencies and institutes) and key informant interviews are presented in the subsequent sections.

- Inadequate skilled manpower in operation and maintenance of rice mills; fabrication of rice mill machines and equipment, management and accounting at rice mill level resulting in poor sub-sector productivity: Due to change in market demand the husking rice mills are becoming inappropriate in terms of financial assessment
- Lack of market linkages for small farmers, traders, and processors with large urban markets
- lack of convenient access to the financial market by farmers, small traders, and processors resulting in little or no gains from economy of scale. Lack of adequate appropriate drying and storage facilities resulting loss of revenue from sales of rice by farmers' and traders' during harvesting season
- lack of steady electricity supply to rice mills' the production is hampered rice was hijacked and looted during transport, that demotivated the millers. Increased transport cost in peak season resulting in low profit margin to rice mill owners
- Lack of modern technology at husking and traditional rice mills resulting in huge loss of rice and poor quality of products

**Business service provisions, providers, their constraints and opportunities**

Business development services associated with the sub-sector are identified. The

research further investigates the constraints associated with the business services and the results were summarized. The research identified the most potential BDSs to target for interventions. The public sector effort to encounter the sub-sector constraints is very insignificant. The public sector institutes such as, PTI, VTI, DYD, BRRI, BARI, BUET, BAU, RDA etc. are providing limited skill training and technological information. The emergence of this sub-sector is a recent event and the public sector institutes like PTI, VTI, and DYD etc are not aware of the requirement of this sub-sector. Therefore, these institutions have mobilized very limited resources to address the needs of this sub-sector. On the other hand, institutions like BRRI, BARI, BUET, BAU, RDA etc are mainly involved in research and education in the sub-sector, and lacking of adequate capacity for training a huge mass. Regarding dissemination of technological information, the institutes are lacking of adequate networking with the grass-root level entrepreneurs. Private sector repair and maintenance workshops are providing most of the skill mechanics through apprenticeship. However, these private workshops are lacking of modern technologies and related skills. Some private training institutes such as MAWTS (Dhaka), MATI (Bogura), CCTS (Jashore) and similar local enterprises are offering skill training on fabrication and machining, and operation, repair and maintenance of machinery and equipment, but their capacities are very limited. However, these programmers are lacking of continuity and mostly unable to fulfil the expectation of the sub-sector.

The entrepreneurs are also facing difficulty in recovery of credits, and frequently suffering from inadequacy of working capital. Market information is usually flow among the actors of the supply and value chains as embedded service, and mostly limited to product quality and market demand. Information related to new technologies, product development etc is still beyond the usual activities of these channels. The associations of manufacturers and traders are offering limited assistance to recovery credits, but these organizations are not strong enough to support whole range of credit recovery activities. NGOs, government and private banks are providing credits to the sub-sector actors, but the cumbersome processes of gaining credit keep most of the small size entrepreneurs away from such services.

**Income distribution in parboiled fine and coarse rice value chain**

Parboiled fine rice processed with husking mill, the profit margins were Tk 347 (3.61% value addition at this level) for aratdar, Tk 3,637 (37.84%) for miller, Tk 306 (3.18%) for wholesaler and Tk 750 (7.8%) for retailer (Table 8).

**Table 8. Income distribution in parboiled fine rice value chain.**

| Type of rice mill | Type of Rice | Income (Tk) | | | |
|---|---|---|---|---|---|
| | | Aratder | Miller | Wholesaler | Retailer |
| Husking | Fine | 347 (3.61 %) | 3637 (37.84 %) | 306 (3.18 %) | 750 (7.8 %) |
| | Coarse | 335 (3.98 %) | 2990 (34.86 %) | 220 (2.62 %) | 570 (6.78%) |

Parentheses indicates percent of value addition.

Parboiled coarse rice processed with husking mill, the profit margins were Tk 335 (3.98% value addition at this level) for aratdar, Tk 2,990 (34.86%) for miller, Tk 220 (2.62%) for wholesaler and Tk 570 (6.78%) for retailer (Table 8).

**Employment distribution in rice mill**

Table 9 shows the employment distribution in husking rice mill.

**Table 9. Employment distribution in husking rice mill.**

| Type of rice mill | Employment | | | | | |
|---|---|---|---|---|---|---|
| | Labour, Tk/ton of paddy | Staff cost, Tk/ton of paddy | Labour, man-hr/ ton of paddy | Labour, man-days/yr | Staff, man-hr/ton of paddy | Staff, man-days/yr |
| Husking | 403 | 147 | 14.17 | 2232 | 6.95 | 1095 |

The cost of labour and staff per ton of paddy process in husking rice mill was estimated as Tk 403 and Tk 147, respectively (Table 9). Kibria (2018) reported that staff cost was found in modern automatic rice mills (Tk 101 per ton of paddy processing) mainly because of its higher capacity and automation. In terms of employment opportunity, a husking mill utilized 2232 man-days per year and labour requirement in husking rice mills was found 14.17 man-hr/ton of paddy processing (Table 9). On the other hand, employment in terms of staff, a husking mill utilized 1,095 man-days per year and required 6.95 man-hr/ton of paddy processing.

**Governance: coordination, regulation and control**

Mechanized rice milling started in this part of the sub-continent quite a long time back and is regulated by a similarly old legal instrument titled "The Bengal Rice Mills Control Order, 1943", which came into force on 20th December 1943. During that time single pass rice mills an adaptation of the "Engelberg " coffee hulled was popularly used for milling parboiled rice. In 2008, Food and Disaster Management ministry's, S.R.O. no. 217-law/2008 entitled "Control of Essential Commodities Act, 1956 (E.P. Act. No.1 of 1956) section 3, by dint of this act the government ordered a notification named "Rice procurement and control act 2008. These acts replace the "Bengal Rice mill control order-1943. In the act 2008, it was noticed that,

- Nobody can mill rice with power operated machinery, and cannot buy or sell paddy or rice or rice product without the license of government.
- Government time to time procures rice from licensed rice mills and millers are bound to supply rice as per its need.
- Licensed millers only mill paddy and cannot mill any other products without the prior permission of the government.
- Millers will report to district controller of food after every 15 days' interval about his milling amount, sell, storage and stock and he also report about the position of his store.
- Millers cannot change their business without the concern of government
- Millers buy paddy only the place which written in the license and they cannot buy paddy from other place.

The limitation of the notification "Rice procurement and control act 2008" is that there is no guide line about the quality of parboiled rice. Beside this, by this notification government fixed paddy buying areas in the license, which is not maintainable for the millers at present, rather they are buying paddy from all over the country. There is another issue in the

notification that government would not buy rice from husking mills because of less quality and more loss during milling compared to semi-automatic and automatic rice mills that are operating in the country in large number. When government procures rice from mill, they prescribe in written form to the millers that rice should be well milled, no chalkiness in the belly of rice, well boiled, moisture content should be 14% or less, broken rice not more than 1%, dead or black rice not more than 1%, however, most millers unable to comply this. Moreover, the admissible moisture content (14%) is not suitable for long term storage. There are rice quality standards specified by BSTI, however, the millers do not follow the standard. They only separate very small broken rice and market it as dairy and poultry feed and as well for human consumption. The price of broken rice is almost half of the whole rice.

**Policy intervention for improving rice milling sub-sector**

The following interventions are suggested to achieve adequate benefit from rice mills

- Encourage use of modern postharvest processing technologies such as de-stoner, rubber roll de-husker, polisher, colour sorter etc for processing paddy.
- Considering the market, the husking mill should be modernized to semiautomatic/automatic rice mills. Profitable cases should be financed by institutional sources.
- Ensure regular and undisturbed power supply to the rice mill.
- C.C. loan bank rate should be reduced
- Make available spare parts of reasonable price with good quality.
- Installation of engelberg huller in the country should be banned. Neighbouring countries already banned engelberg huller since 30 years back.
- Vocational training institutes (VTI) may help to produce qualified operators for rice mills.
- Ensure optimum use of rice byproducts.

A good policy, on the other hand, will not help farmers unless it is properly implemented. Transparency and accountability for all stakeholders involved in the implementation, as well as good inter-departmental cooperation, are critical to the success of these policies/strategies.

**Linkage and trust over the chain**

Of the total 28 samples of Paddy aratdar, 13% have maintained informal linkage and 87% maintained verbal linkage arrangement with forward channel, i.e. millers. While at backward channel, 27% paddy aratdar had informal linkage with faria/bepari and 73% aratdar had verbal arrangement of linkage. The level of trust of such linkages by aratdar with faria/bepari was responded as no trust, little trust and some trust by 47%, 13% and 40% respondents, respectively.

Of the total 65 rice millers 40% had informal and 60% had verbal linkages with the rice wholesalers in forward linkage. Level of trust of business linkage by millers with rice wholesalers were recorded as no trust (60%), little trust (15%) and some trust (25%). At backward channel of rice millers 55% had informal linkage with aratdar and 45% had verbal arrangement. Level of trust by millers with wholesalers was recorded as some trust (60%), little trust (15%) and no trust (10%).

Of the total 30 rice wholesalers, 21% had informal and 79% had verbal linkages with the rice retailers in forward linkage. Level of trust on business linkage by rice wholesalers with rice retailers was recorded as no trust (76%), little trust (10%) and some trust (8%). At backward channel of rice wholesalers (56%) had informal linkage with millers and 44% had verbal arrangement. Level of trust by wholesalers with rice retailers was recorded as some trust (76%), little trust (16%) and no trust (8%).

**Identification and Selection of Facilitation Activity**

**Short listing of service provisions for facilitation**

Based on the information collected from the value chain actors and the key informants the probable business service provisions were narrowed below for priority intervention. The business services were judged by four important indicators such as, unmet market demand, potential for market growth, potential for employment generation and public sector interest with relative strength of 4x, 3x, 2x and 1x, respectively (Table 10). The indicators were identified in consultation with the key informants. Each business service was also given a score of 1 to 5 (with 1 being the lowest and 5 being the highest score) depending upon their relative weightage. The score of a business service was then the product of relative weightage and the strength. Then the business services were ranked based on the total score. The top five business services may be selected for immediate intervention.

**Table 10. Ranking of service provisions for intervention.**

| Business development services | Unmet market demand (4x) | Potential for market growth (3x) | Potential for employment generation (2x) | Public sector interest (1x) | Total score | Rank order |
|---|---|---|---|---|---|---|
| • Provisions for training on operation, maintenance and repair of rice mill to operators and technicians | 16 | 12 | 8 | 4 | 40 | 1 |
| • Provisions for training on fabrication of rice mill equipment to mechanics | 12 | 9 | 4 | 1 | 26 | 10 |
| • Provisions for training on management, accounting and marketing skill to management personnel | 12 | 12 | 2 | 1 | 27 | 9 |
| • Provisions for awareness building about modern technologies of semi-automatic and automatic rice mills among the husking rice mills owners | 12 | 9 | 4 | 4 | 29 | 7 |
| • Provisions for replacement of husking rice mills by semi-automatic and automatic rice mills | 16 | 12 | 8 | 3 | 39 | 2 |
| • Provisions for credit facilities for replacement of husking rice mills by semi-automatic and automatic rice mills | 16 | 9 | 8 | 2 | 35 | 3 |
| • Provisions for developing business model for replacement of husking rice mills | 12 | 6 | 4 | 3 | 25 | 11 |

**Table 10 (continued)**

| Business development services | Unmet market demand (4x) | Potential for market growth (3x) | Potential for employment generation (2x) | Public sector interest (1x) | Total score | Rank order |
|---|---|---|---|---|---|---|
| • Provisions for business model for incorporating modern technologies in older generation semi-automatic and automatic rice mills | 16 | 9 | 6 | 1 | 32 | 6 |
| • Provisions for credit facilities for replacing older generation technologies in semi-automatic and automatic rice mills | 12 | 6 | 6 | 4 | 28 | 8 |
| • Provisions of non-interrupted supply of electricity to producers and sellers | 12 | 9 | 2 | 1 | 24 | 12 |
| • Provisions for access to knowledge and skill to replace engelberg huller by rubber roll huller to husking and traditional rice mill owners | 12 | 12 | 6 | 3 | 33 | 5 |
| • Provisions for legislation to replace engelberg huller by rubber roll huller of husking and traditional rice mills | 16 | 9 | 6 | 3 | 34 | 4 |

## CONCLUSION

This research aimed to investigate the key problems and opportunities throughout the value chains for the growth of the husking rice milling sub-sector in Bangladesh. These issues are crucial for the improvement of the rice value chains, in terms of growth of this emerging sub-sector. Where possible, it also suggests policy implications and discusses some relevant interventions.

- Husking mills are still dominating in the rice milling sector; however, inappropriate technologies at husking and traditional rice mills resulting in improper milling, having large quantity of broken and black rice and not free from stones, thereby fail to compete with modern automatic and semi-automatic rice mills in terms of quality of rice and market demand. Even, byproducts such as husk and bran are remaining mixed and therefore, have less market demand and only used as local poultry and cattle feed. Therefore, husking rice mills need to be replaced by semi-automatic or automatic rice mills.
- Traditional husking mills operating all over rural Bangladesh need to be upgraded to improved air-blow type husking mills with small polisher or by rubber roll de-husker and a small polisher unless the milling sub-sector is fully automated.
- There are two major value chains of milled rice, fine rice value chain and coarse rice value chain. The share of parboiled milled rice is about 90% of the total milled rice production.
- The main actors of fine and coarse rice value chains are rice faria/Bepari/ aratdar/commission agent, rice miller, rice wholesaler and rice retailer.
- In both fine and coarse rice value chains, major value addition and profit margin

take place at millers' level and dominating the whole chain. These rice millers control the paddy market through their employed agents and buy most of the paddy from beparies and farias in peak season and stockpile for rest of the season.

- "Rice procurement and control act 2008" is the major policy guide for controlling the rice milling sub-sector. However, there is no guide line for milled rice, and there is no instruction for the government not to procure rice from husking mill, as there are a number of semi-automatic and automatic rice mills already operating in the country which produce good quality milled rice with less loss.
- Due to high price fluctuation in rice market, mostly verbal linkages are maintained among the actors of rice value chain. In transactions, some to little trust are exists among miller, bepari and faria, however, no trust is existing among others actors.

## RECOMMENDATIONS

The following priority recommendations for intervention by competent authorities are made on the basis of the above discussion:

- A special training institute on rice milling industry need to be establish to create skilled manpower for operation and maintenance of rice mills. Public sector institutes, especially the Ministry of Food and Disaster management can take initiative in this regard
- Establishment of a 'Rice Processing Hub (RPH)' on the outskirts of Dinajpur, Kushtia, Noagaon, Sherpur, and Mymensingh towns to accommodate existing and potential rice processing industries and manufacturers and to ensure infrastructural facilities such as non-interrupted electricity, gas, and water supplies.
- Long and mid-term credit facilities that are soft and flexible for capital equipment and working capital are to be accessible. The emergence of this sub-sector is a recent event and the public sector institutes like PTI, VTI, and DYD etc are not aware of the requirement of this sub-sector. Appropriate modules and courses need to be adopted in these institutes to meet the need of technical knowledge and skill of this sub-sector. Course and curriculum at tertiary level educational institutes (universities) to be strengthened for quality knowledge and business service provisions for rice milling sub-sector.

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